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10/511819

DT05 Rec'd PCT/PTO 19 OCT 2004

CONVEYOR LINE WITH AN ADJUSTABLE RAILING AND AN ACTUATOR DRIVE

[0001] This invention relates to a conveyor line for products such as bottles, cans or similar containers according to the preamble of Patent Claim 1; it also relates to an actuator drive according to the preamble of Patent Claim 25.

[0002] Adjustable railings on conveyor lines for bottles or similar containers are known for adjusting the conveyor width, i.e., the spacing between railings on containers of different diameters (German Patent DE 43 30 702 A1, German Patent DE 697 09 943 T2, United States Patent 6,382,882 B1). These railings are used to guide the containers laterally in a path and to prevent them from getting out of line across the direction of conveyance, which can lead to blockages in congested situations. In the known cases, adjustment of the railing is implemented by means of pneumatic cylinders, the end positions of which can define only two different positions. Furthermore, it is known that multiple pneumatic cylinders may be linked together to create more than two positions. The solution requires extensive assembly work, takes up a lot of space and causes a great complexity in terms of the control technology.

[0003] The object of this invention is to provide an adjustable railing and an actuator drive for it to allow a lateral adjustment and accurate fixation of different predefinable positions with a simple structural design.

[0004] This object is achieved through the characterizing features of Claim 1 and/or 25.

[0005] For each product shape to be processed, a preset stationary position is provided for a stop, which can be moved either manually or by control means from a readiness position into or out of a working position which blocks the adjustment pathway of the guide railing or the actuator drive that operates the railing. In the ideal case, each position is assigned its own stop, which is movable back and forth between the aforementioned two positions and can be brought into contact with an opposing stop, which follows the adjusting movement.

[0006] However, a smaller number of stops may be sufficient if they can be moved either manually or by control means, e.g., by a manipulator, into various positions which determine the position of the railing. In the case of a manual adjustment of stops, it is advantageous to provide a code which is assigned to different product shapes and indicates the respective positions, e.g., with colors or other suitable markings

[0007] The railings can be fixed in a position which corresponds to a largest and a smallest product shape by just two stops which can be handled adequately manually, regardless of the end positions of the actuator drive used which are predetermined by the design. For other product shapes, which require positions in between these two extremes, stops that are operated by a control means are advantageous because then at least three different positions of the railings can be set and changed quickly without manual intervention, in particular when a controller is used, preferably a programmable controller, for the actuator drives and the stops which can be operated by control means. Then the format can be changed quickly and automatically by a control command.

[0008] According to a preferred embodiment, the actuator drive for the adjustment of the railing is a linear drive. Its axis of adjustment is ideally arranged to run at a right angle to the direction of conveyance of the conveyor line so that it may at the same time as a railing mount or carrier. The preset positions for the stops are arranged in stationary positions in the adjustment pathway of the linear drive or the railings along the axis of adjustment. A direct allocation of the positions to the linear drive, e.g., by a stop mount that determines the positions, is particularly advantageous. It may be designed as an integral component or as an attachment to the linear drive whose position in relation to the linear drive can be secured immovably.

[0009] An especially inexpensive embodiment of a linear drive is a preferably double action pneumatic cylinder with a cylinder element and a piston guided so that it is coaxially displaceable therein and has a piston rod, whereby one component of the stop mount forming the cylinder housing is set so that it is

aligned in the axial direction with the cylinder element, with an axial bore passing through the lengthened piston rod. The diameter of this axial bore is advantageously selected to be greater than the outside diameter of the piston rod, forming an annular space with stops passing through it. In the area of the axial bore, there is an opposing stop which is connected to the piston rod in terms of movement, preferably having a disk-shaped contour and an outside diameter that corresponds approximately to the inside diameter of the axial bore. If the length of the axial bore corresponds at least to the maximum adjustment pathway of the pneumatic cylinder, then the entire adjustment pathway is available for positions that are designed to accommodate stops and can be preset in advance.

[0010] These positions are preferably designed as recesses, in particular boreholes running across the adjustment path and/or the axial bore. They may be designed to run at a right angle from one side of the lateral surface of the stop mount continuously to the opposite side of the lateral surface of the annular space. A nail-shaped pin, for example can be inserted in a form-fitting manner into such a borehole as a stop body which passes through the annular space and protrudes into the path of travel of the opposing stop. Multiple bores may also be arranged in a row running along the adjustment path or may even be arranged in multiple parallel rows, thus making it possible to implement a spacing offset between the bore rows with positions for stops very close together in the axial direction. The entire circumference of the lateral surface of the stop mount is available for this. Thus any position can be preset at intervals of 2.5 mm, for example. By using plug elements, it is possible for all positions to be occupied in the ideal case. This yields the possibility of adjusting the railing positions across the direction of conveyance to fit a variety of product sizes.

[0011] This solution allows a very compact, mechanically simple and thus inexpensive design of an actuator drive which takes up slightly more length only in the axial direction in comparison with a conventional pneumatic cylinder.

[0012] In addition to the boreholes mentioned above, other possible stop positions such as notches, grooves, slots or the like may also be provided on the

body of the stationary stop mount. Likewise, all bodies suitable for this purpose, e.g., screws, needles, disks, rings or other elements may be used as stops.

[0013] Other advantageous embodiments are the object of the remaining subclaims.

[0014] An exemplary embodiment is described below on the basis of the figures, which show:

Figure 1	a vertical section through a pneumatic conveyor,
Figure 2a	a control cylinder with a stop mount,
Figure 2b	a vertical longitudinal section through a control cylinder according to Figure 2a with stops for defining positions,
Figure 3	a side view of a stop mount as seen from direction X in Figure 2b and
Figure 4	a vertical section through a pneumatic conveyor with guide railings that are adjustable in height.

[0015] Figure 1 shows a vertical section through a pneumatic conveyor 1 as seen in the direction of conveyance, transporting bottles 16 on a carrying ring 17 so that they are suspended, with actuator drives 2 fixing the position of the guide railings 6 which run parallel with an intermediate spacing between them. The actuator drives 2 are each mountable in a fixed position in relation to the frame with a flange plate 18 on vertical supports 5. The flange plate 18 has fastening boreholes 19 with which it is attached to the vertical supports 5. Elongated holes are preferably provided in the vertical supports 5 to permit a height adjustment of the actuator drive 2 with the guide railings 6 mounted directly on the supports with a variation in the bottle height.

[0016] The pneumatic conveyor 1 has essentially a closed approximately U-shaped air guidance box 3 which is supported by vertical supports (not shown in detail), and which is constantly supplied with air in an essentially known manner by multiple blowers (not shown) arranged so they are offset in the direction of conveyance. A roof-shaped nozzle channel 4 which is provided on the underside of the air guidance box 3 has two sliding rails 15 running in parallel beneath it,

gripping the supporting rings 17 of the plastic bottles from underneath, the cross section of this nozzle channel being of dimensions such that the head area of a bottle 16 has room to move on all sides.

[0017] On both sides of the air guidance box 3, the vertical supports 5 at regular intervals in the direction of conveyance extend downward, with guide railings 6 that run parallel to the direction of conveyance being supported in a laterally adjustable manner over the actuator drives 2 mentioned above. These railings 6 which are arranged in opposing pairs at the same height together with the sliding rails 15 which guide the head area of the bottles form a guidance channel, which prevents a lateral pendulum movement or swerving of the bottles 16.

[0018] The guide railings 6 are mounted across the direction of conveyance at a distance which is slightly greater than the diameter of the bottles 16 to be transported: to support the guide railings 6, the actuator drives 2 are mounted on the vertical supports 5 at a right angle with respect to their axis of adjustment, such that stop mounts A with preset positions 7, 7', 7", etc. and stops 8a, 8b, 8c which can be introduced into them are provided on the outside facing away from the articles 16. The piston rod 10 of the actuator drive 2 which is designed as a linear pneumatic cylinder is aligned horizontally here.

[0019] Figure 2a shows a pneumatic actuator drive 2 which consists of a cylinder body 9 and a piston rod 10 which is guided coaxially in it and has an attached piston 10'. Its end positions define a maximally available adjustment path S which the piston rod 10 may travel (see Figure 2b). The stop mount A which engages in a form-fitting manner in the cylinder body 9 is mounted on one end of the cylinder body 10 by means of a centering shoulder 12. The stop mount A is connected axially via the tension anchor 20 to the flange plate 18 which is positioned on the opposite end of the cylinder body 9. The mounting boreholes 19 mentioned above are incorporated into the flange plate 18, serving to securely clamp the actuator drive 2 with screws on the vertical supports 5 which have slots for free passage of the piston rod 10 to the railings 6. The flange plate 18 has a centered borehole which is not shown in detail here and in which the piston rod 10 is guided axially.

[0020] The stop mount 8 is preferably designed as a hexagonal profile (shown in Figure 3). Preset positions 7, ..., 7"" in the form of through-holes, threaded holes or other recesses are provided on two opposing parallel faces of the stop mount A. It is possible to introduce the preset positions 7, etc. on all six sides of the stop mount A, e.g., in the form of rows of holes. They are, for example, designed in two parallel rows which may be arranged so they are offset with respect to one another by half the standard spacing to obtain a tightly graduated position grid.

[0021] Figure 2b shows a vertical longitudinal section through the actuator drive 2 in which an axial bore 13 is visible through the stop body A. The inside diameter D of the borehole 13 is greater than the outside diameter d of the piston rod 10. This forms an annular space 14 in the interior of the stop mount A through which the stops 8a, 8b, 8c may extend (e.g., pins with heads). Furthermore, this figure shows the stops 8a, 8b, 8c in preset positions 7, etc. which can be brought to rest against an opposing stop 11 on the piston rod 10. The opposing stop 11 has two faces 11a, 11b which face away from one another. In this case it is designed in the form of a washer which is secured on the piston rod. The diameter of the plate that is bolted on is slightly smaller than the inside diameter D of the axial bore 13 of the stop mount A. The preset positions, i.e., bores 7, 7', 7", etc. are designed continuously over the entire cross section of the stop mount A. In the set position of the stops 8a, 8b, 8c, they pass through the entire stop mount A. The bores thus ensure guidance of the stops 8a, 8b, 8c on both ends. The precise guidance of the stops 8a, 8b, 8c which are designed in the form of pins, needles or the like, ensures a precisely adjustable positioning of the railings 6.

[0022] The stops 8a and 8b which can be seen in Figure 2b are in the working position, i.e., in the traversing path of the opposing stop 11, while the stop 8c assumes a position of readiness outside of the traversing path. The stop 8c is displaceably guided in a cylinder housing 8c' which is screwed at a right angle into the stop mount A, forming together with the latter a double-acting pneumatic cylinder in a miniature design, i.e., this stop, like the actuator drive 2, can be acted upon alternately with compressed air in a known manner via a control means and

electromagnetic valves (not shown), e.g., in a program-controlled process, and thereby moved in opposite directions. In its working position, it can optionally be brought into engagement with one of the two stop faces 11a, 11b on the opposing stops which face away from one another so that with the three stops shown, a total of four different preset railing positions are already possible even without changing the stops manually.

[0023] Figure 3 shows a side view of the stop mount A as seen from direction X, the stop mount being mounted on the cylinder body 9 shown in Figures 2a and 2b. An annular space 14 which is formed by an axial bore 13 in the interior of stop mount A and piston rod 10 is also visible. This view shows, first, the hexagonal shape of the stop mount A which has already been described and, second, the embodiment of the preset positions 7, 7', 7", etc. designed in the form of through-holes with the entire arrangement passing through the entire body. In the retracted state the stops 8a, 8b, 8c pass through the annular space 14 at a right angle to its longitudinal extent and can be brought to rest against the opposing stop 11 in this traversing movement.

[0024] Figure 4 shows an advantageous refinement of the railing adjustment which is illustrated in Figure 1 and has a manual height adjustment, while the embodiment shown here permits an adjustment of the height position of the railing to accommodate different bottle heights in an at least partially automated form. The actuator drives 2 which move the guide railings permit a horizontal adjustment across the direction of conveyance and are each mounted on a sliding piece 21 that is guided displaceably axially along a vertical support 5. The sliding piece 21 has an angle 22 with a leg running horizontally, the piston rod of an actuator drive 2' being attached to the leg and aligned vertically, i.e., parallel to the longitudinal extent of the vertical support. This actuator drive 2' may have the same design as the actuator drives 2 shown in Figures 1 through 3. In Figure 3 the stop mounts and the actual cylinders are designed in one piece to be made of a hexagonal material. If necessary, the actuator drive 2' has a greater maximum adjustment path because a greater bandwidth may be necessary for an

adjustment of the guide railings longitudinally to the axis of the bottle than for an adjustment across the axis of the bottle, i.e., the actuator drive 2' may be designed to be longer on the whole and to have more preset positions 7, ..., 7''' accordingly for attaching stops. These stops may be designed like those in Figure 2b as manually adjustable pins or the like and/or as remote-controlled stops in the form of miniature pneumatic cylinders, magnetically operable stops or those operable by some other form of motor drive, thus permitting an especially convenient, fast and simultaneous means of performing adjustments of both the height and transverse positions of the guide railing 6 of a complete conveyor system when there is a change of types of bottles processed and this makes it possible to perform these adjustments from a central location. Actuator drives 2 and 2' as well as the remote controlled stops (miniature pneumatic cylinder 8c) can be triggered in the correct order of operation. To do so, pneumatic valves that can be operated by hand from a central location may be provided. However, it is especially advantageous to have a central control which is operable via a programmable controller whose program memory contains a type selector switch or a switching program that can be called up for each type of bottle to be processed such that this program need be installed only once and thereafter executes a switch in type of bottle processed on a fully automatic basis.